Fernow Experimental Forest

Forest Service USDA

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Northeastern Forest Experiment Station
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PROFILE OF THE FERNOW EXPERIMENTAL FOREST

Approximately 78 percent of the land area in West Virginia is forest-covered. The State's economy depends heavily on its forests for wood production, recreation, wildlife and for other uses. Research into better forest management is done on the Fernow in the hope that results can be applied toward maintaining the productivity and diversity of the soil, water, and forest resources of West Virginia.

In 1934 a portion of Monongahela National Forest land was recognized as representative of much of the timberland in West Virginia and adjacent states in topography, history of cuttings, climate, and variety of species. It was set aside for research use and designated the Fernow Experimental Forest in memory of Bernhard E. Fernow, a pioneer in American forestry research. The experimental forest, with recent land acquisitions from the Monongahela National Forest now totals approximately 4,700 acres.

Today the Fernow Experimental Forest is a thriving field laboratory for the research project "Sustainable Forest Ecosystems in the Central Appalachians." This project of the USDA Forest Service is headquartered at the Timber and Watershed Laboratory at Parsons, WV.

Entrance to the Fernow Experimental Forest.

Soils

The Fernow Experimental Forest lies in the Allegheny Mountain section of the unglaciated Allegheny Plateau. Its elevation ranges from 1,750 to 3,650 feet, and its slopes are generally steep.

A rock layer composed of fractured hard sandstone and softer shale underlies most of the forest. A majority of the Fernow soils are of the Calvin and Dekalb series which originated from these rocky materials. At one point, beyond Big Spring Gap, a belt of Greenbriar limestone outcrops in places to produce a mid-slope zone of limestone soil of the Belmont series.

Almost all Fernow soils—including the sandstone, shale, and limestone soils are well-drained, medium textured loams and silt loams. Stoniness is characteristic of the Fernow. Average soil depth is about 3 feet.

Climate

The Fernow Experimental Forest has a rainy and cool climate. Mean annual precipitation is about 58 inches, concentrated in the winter, spring and summer months. Mean annual temperature is about 48 degrees Fahrenheit, and the length of the frost-free season is about 145 days.

Because of elevation, winters are more severe on the Fernow than in lower surrounding areas. Annual snowfall is heavy. Temperatures between 10 and 20 degrees below zero (Fahrenheit) are not uncommon.

Drainages

The Fernow Experimental Forest encompasses practically the entire Elk Lick Run drainage—about 3.8-miles long and 2.3-miles across at the widest point. Elk Lick Run has seven major tributaries including Big Spring, which drains a headwater limestone formation. Headwater areas on two of these tributaries have been gaged to show how forest management influences streamflow.

Roads

Most of the roads on the Fernow Experimental Forest are a part of the Monongahela National Forest road system. The main Fernow road is open for public use. Follow the signs from north of the Shavers Fork bridge in downtown Parsons to the Fernow Forest.

Forest Sites

Tree growth, like the growth of field crops, reflects the influence of soil, topography, and climate. The combined influence of these factors determines "forest site."

Site quality is generally measured as the height of dominant and co-dominant forest trees at a given age–usually 50 years. This is known as "site index." The timber yield per acre is related to this index.

Based on site index, almost all areas on the Fernow can be rated as excellent, good, or fair. These designations correspond to oak-site indexes of 80, 70, and 60 feet respectively. The effects of different site quality are important in the overall research program.

Tree Species

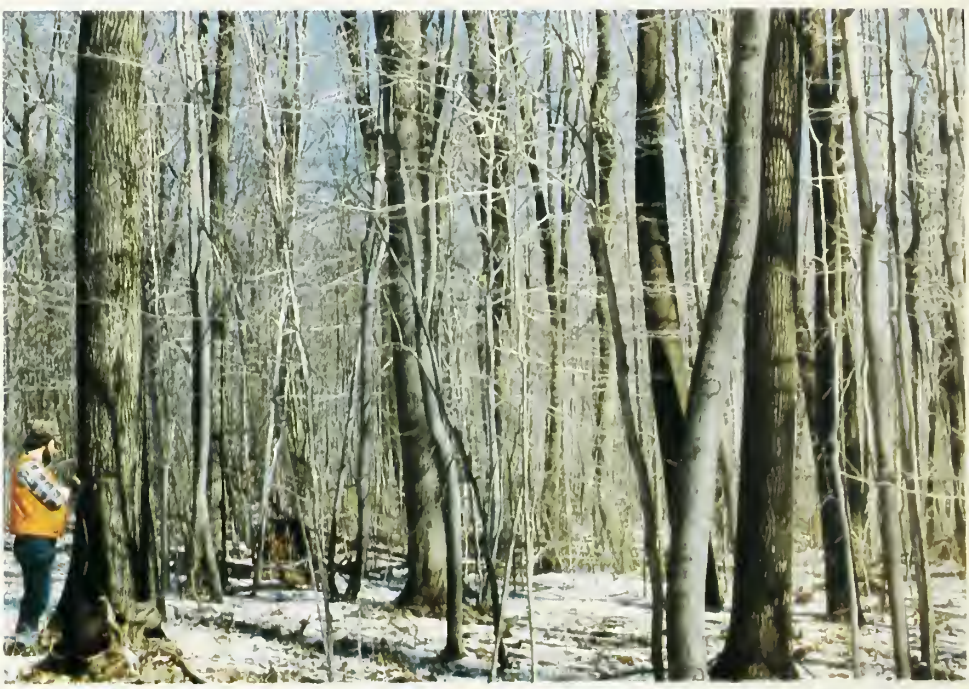
The Fernow Experimental Forest is primarily a hardwood forest. Upland oaks are the most common species group. Northern red oak, which is found on all sites, is very abundant. Chestnut oak and white oak are the next most abundant oaks. These two species, although seldom found on the excellent sites, are more common than red oak on the fair sites. Scarlet oak and some black oak can also be found on fair sites.

Beech and sugar maple are numerous on all but the poor sites. Yellow-poplar makes up a large part of excellent and good-site stands, along with black cherry, white ash, and basswood. Scattered trees found in mixture on these sites include yellow birch, cucumber tree, butternut, black walnut, and elm.

Red maple, black locust, sweet birch, and—to a lesser extent—Fraser magnolia are consistent, but generally minor, components of the forest on all sites. Black gum, sassafras, and sourwood are poor-site trees of little commercial importance. Among the shrubby tree species are flowering dogwood, pin cherry, striped maple, and downy serviceberry.

Wildlife

The Fernow Experimental Forest contains a wide variety of wildlife. Among the species represented are: White-tailed deer, black bear, wild turkey as well as many species of neotropical birds and aquatic life.



Red Oak–A Common Species on the Fernow.

Cooperation

Research on the Fernow Experimental Forest by the Timber and Watershed Project scientists is done in cooperation with the Monongahela National Forest, the University of West Virginia, Marshall University, Penn State University, Virginia Polytechnic Institute, and the West Virginia Division of Natural Resources.

Research results are made available in government publications, as well as in professional and trade journal articles, to public and private foresters, landowners, timber operators, students, and forest scientists in West Virginia and neighboring states

LOCATION

The Fernow Experimental Forest is located in the most mountainous region of West Virginia, the "Mountain State." It is surrounded by the Monongahela National Forest.

○ The Monongahela National Forest, whose Indian name means "River of Sliding Banks," comprises about 900,000 acres of rugged, hilly terrain. It provides recreational opportunities for thousands of campers, swimmers, picnickers, hunters, and fishermen each year.

○ The Fernow is situated off Route 219, just south of the city of Parsons, home of a number of woodworking industries and the world's largest charcoal manufacturing plant.

○ Visitors are welcome to tour the Fernow Experimental Forest. Show-me trips, which provide a lecturer or a guided tour through the Forest, can be arranged for interested individuals and groups by contacting the Timber and Watershed Laboratory, Nursery Bottom, Parsons, W. VA 26287; Phone: (304) 478-2000.

THE NORTHEASTERN FOREST EXPERIMENT STATION

A regional research branch of the USDA Forest Service, the Northeastern Forest Experiment Station is charged with federal forestry research responsibilities throughout the most populated portion of the country. Northeastern Forest Experiment Station field locations are: Amherst, MA; Orono, ME; Burlington, VT; Durham, NH; Hamden, CT; Warren, PA; Delaware, OH; Morgantown, WV; Parsons, WV; Princeton, WV; and Syracuse, NY; Headquarters is Radnor, PA.

The research that scientists do at these 11 field locations of the Northeastern Station covers a wide variety of scientific disciplines, including basic research to understand ecological processes; management of forests and related wetland and aquatic ecosystems for wildlife habitats, clean water, timber, and recreation; protection of forests from damages due to insects, diseases, air pollution, and climate changes; forest inventories and economic analyses; and wood utilization research from harvesting through manufacturing and marketing.

Several of the research projects of the Northeastern Forest Experiment Station are unique to the national Forest Service research program. For example, Northeastern Station scientists are conducting studies on wildlife communities and habitat relationships in eastern hardwood forests from West Virginia to New Hampshire not only for larger animals like deer and wild turkey, but also for migratory songbirds, bats, and salamanders, which are important indicators of the health and sustainability of forests. Also, researchers are developing biological control agents that are specifically targeted on forest pests, such as the gypsy moth and hemlock woolly adelgid, and safer than the persistent chemical products used in the past.

Engineering researchers are developing technology that will increase productivity and profitability in the field and factory, while being safer for employees to operate. Satellite pictures are being used for forest inventories to reduce field data collection costs.

A unique attribute of Forest Service research is our ability to conduct long-term studies. The Northeastern Station is 75 years old. Some of our experiments were installed in the late 1920s and early 1930s. Because trees grow slowly, long-term studies are essential to evaluate the effects of management activities. For example, scientists at Parsons developed an improved even-aged management system for mixed oaks and associated hardwoods. The system is now being used by National Forests and many state and commercial forest landowners in the East.

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A GUIDE TO FERNOW STUDIES

The forests of the central Appalachian mountains are an important resource to the millions of people who live in and around the area and to the many visitors to the region. The mixed hardwood forest, which covers about 78 percent of West Virginia, supplies important timber products, provides recreational opportunities, and supports a diverse assemblage of wildlife and plant species. Timber harvests are increasing each year in West Virginia. Other competing interests are also demanding that the forests be maintained as a high quality resource.

Sustainable management of these forests for such a variety of land uses is complicated by an incomplete understanding of these complex ecosystems and of the role of natural and human-induced disturbance in their structure and functioning. For this reason, more information is needed on ecosystem processes and silvicultural alternatives. The forestry management practices need to be identified which will promote the sustainability of these forests for growth of timber, recreational use, provision of high quality water, and as habitat for a variety of wildlife and plant species.

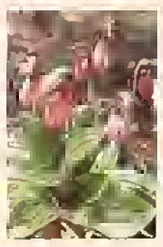
Scientists at the Fernow Experimental Forest are developing information and techniques for establishing and growing quality hardwoods—especially northern red oak, the most important timber tree in the central Appalachians. Application of research results will, hopefully, stimulate the economy of the region through improved wood production efficiency and through better coordination of the forest's many uses. Scientists at the Fernow are also learning how hardwood forests can be managed to provide more clean water. Although water is generally abundant in West Virginia, it is sometimes scarce during late summer and is often polluted. Scientists are promoting improved watershed management practices in the central Appalachian mountains, so that more rainfall can be made available for human use.

THE FERNOW TOUR

Fifteen points of interest are marked and numbered along the tour route. At several stops there are signs to describe the research conducted at that location. Although the marked stops cover only a small portion of the extensive research activities, they are fairly representative of the important studies being conducted throughout the Fernow.

Wild Turkey

Ginseng



Pink Ladies Slipper

Black Bear

Biological Control Area (Stop 4).

(1) START OF TOUR: This stop demonstrates the logging/land use history, geology, climate, and aspect of the Fernow Experimental Forest. The Elk Lick watershed generally faces north and receives an average annual precipitation of 58 inches per year. The soils were formed predominantly from sandstone and siltstone and most are in the Calvin and Dekalb series. The elevation ranges from 1,750 to 3,650 feet. As in much of West Virginia large scale logging occurred here from 1905 until about 1910 and was accomplished by horse and railroad. Early logging was heaviest near the streams and more selective on the ridges, with fires often following logging.

From here you can view the Fish Trough Deferment study across Elk Lick Run. Deferment cutting, a regeneration practice that promotes a variety of commercial hardwoods and maintains a two-age stand structure for aesthetics, wildlife habitat, and other non-timber benefits, entails leaving 12-15 mature trees per acre and removing all other trees. Every 80 years the practice is repeated, so there are always mature trees on the land. Deferment cutting was applied in this stand in 1981 when the mature trees were 75 years old. The young trees developing beneath the mature trees regenerated naturally after logging and will be mature in 2061.

(2) WILSON HOLLOW WEIR: This is the largest gaged watershed (325 acres) on the Fernow. The concrete dam (cutoff wall) is anchored to bedrock across the stream channel so all the water draining from the watershed is forced to flow through the control section (notch). The weir pond and stilling well located beneath the weir house are connected by pipes so that water levels are monitored by water level recorder. These measurements enable scientists to determine the quantity and timing of stormflow draining from the watershed.

Another stream-gaging station (Watershed 1), typical of smaller watersheds on the Forest, is located 100 yards up the trail. A slightly different weir is being used at Watershed 1 to measure streamflow because this watershed is much smaller (74 acres) than the Wilson Hollow watershed. Beginning in 1951, water samples have been collected weekly from all the gaged watersheds to determine the physical and chemical characteristics of water draining from them. This long-term data base is very valuable because it enables scientists to detect subtle changes in forest ecosystems over time.

(3) PARSONS RESERVOIR: Constructed in 1934-36 by the Civilian Conservation Corps, this reservoir is one source of water for residents of the City of Parsons.

Weir and Gaging Station for a Watershed.

(4) BIOLOGICAL CONTROL AREA: Many of the trees on this site are 100 years old. It is believed that the previous stand on this site was decimated by a tornado about 100 years ago. This stand will remain as a control area against which to compare the development of stands under the various types of management. Many forms of animal and plant life are observed in the control area.

(5) ZERO GRADE TRAIL: The Zero Grade Trail provides access to some of the oldest research and forest management demonstration areas in the eastern United States. As the name implies, the trail was located to minimize the effect of the rugged terrain. Original construction was done by the Civilian Conservation Corps in the 1930s and was upgraded in 1994 to universal access design standards for remote forest settings. The trail is approximately 1/4-mile long. Try it—it's an easy stroll.

(6) EVEN-AGED MANAGEMENT: An even-aged stand is one in which the dominant trees originated at about the same time and developed under essentially full light conditions. Even-aged management provides for more successful reproduction and early development of tree species that need direct sunlight—yellow-poplar, white ash, basswood, black cherry, and red oak. The dense, uniform canopies of even-aged stands restrict the amount of light hitting tree trunks. This lessens the chance for excess branching, which could cause knotty wood.

This site was first cut in 1961 and seed trees were left to facilitate natural regeneration. Seed trees were removed in 1964 as part of a program to determine the effects of even-aged silvicultural treatments on the reproduction, development, and quality of northern Appalachian hardwoods.

(7) CROP-TREE MANAGEMENT: This compartment is used to study crop-tree management in 80-year-old central Appalachian hardwoods. Crop trees are trees favored for their potential to produce high-quality wood, provide food or shelter for wildlife, or other desired benefits. The area is divided into four 6-acre treatment units. Within each treatment unit, crop trees to be retained for the future were selected using the "crown-touching" approach. After treatment, crop trees would be free-to-grow or would be touching the crown of only one other crop tree. Cutting treatments were applied to each area in 1989. The treatments varied from removing only trees touching the selected crop trees to removing all trees except the selected crop trees. Where all trees except crop trees were removed, a two-age stand is developing where the taller trees are 80 years older than the young trees growing beneath them. Residual trees in all treatment areas are growing faster because competing trees have been removed. Tree growth, nesting productivity of birds, and aesthetics will be monitored here until 2069.

(8) PATCH CUTTING: Patch cut harvests are made in 0.4-acre openings. These openings are large enough to provide sufficient amounts of sunlight for the light-demanding species, such as yellow-poplar and black cherry. Approximately 1/8th of the area of this stand is cut every 10 years. After each cut a new age class begins to develop. This stand has a relatively high density of species, age classes, and vertical strata.

Patch Cutting Area.

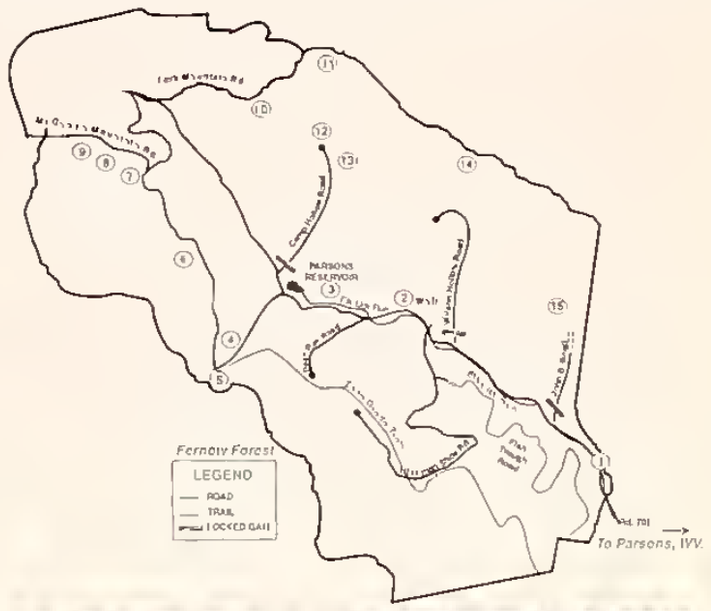
(9) UNEVEN-AGED MANAGEMENT: Uneven-age management entails maintaining trees of different age classes in the same area. Successful uneven-aged management calls for more or less equal, periodic harvests. Under this practice, trees are removed on an individual basis to leave a desired number of trees in each size class so that a variety of goals can be met. Each harvest stimulates reproduction of new trees and enhances the growth and yield of older trees. Partial cuts are applied here every 10 years.

(10) WATERSHED 5: This area has been managed using the single-tree selection method since 1958. Every 10-15 years, some trees are removed to control the number of trees in each size class.

Cutting individual trees does not create large enough openings to allow shade-intolerant (light demanding) trees to become established and grow to maturity. Instead, shade-tolerant species such as maples and beech regenerate naturally to replace trees that are removed. Data collected since 1958 indicate that the number of valuable shade-intolerant trees in this stand are decreasing while there has been a dramatic increase in shade-tolerant trees.

(11) WATERSHED 4: Since 1951 this watershed has been used as an untreated control. The trees growing on this area are also used as a reference for timber management studies. By maintaining this watershed in a natural state and comparing water quantity and quality data collected on the control watershed with that collected on treated watersheds, scientists can determine the degree of change brought about by various timber and watershed treatments.

(12) WATERSHED 3: Trees on this watershed were first harvested in 1958 by intensive selection of trees larger than 5.0 inches diameter breast height (DBH). It also received light partial cuts in 1963 and 1968. Then in 1969 the entire watershed was clearcut down to 1-inch DBH except for a 7.4-acre protective strip of uncut trees left along each side of the stream channel. Logging roads were carefully laid out to provide efficient harvesting of forest products without harming other resources. The primary purpose of this study was to evaluate the effects of clearcutting on the quality and quantity of streamwater.



Example of Crop Tree Forestry Management.

(13) WATERSHED 2: Beginning in November 1990, agricultural ground limestone has been applied every other year at the rate of 3 tons per acre to the 11.3-acre riparian zone around the stream. The purpose of this experiment was to investigate the possibility of reducing the acidity of streamwater by applying lime to the watershed it drains. The effects of this liming treatment on streamflow and soil chemistry are still being studied.

(14) WATERSHED 7: Streamflow measurements also began on this watershed in 1956. The upper half of this watershed was clearcut in 1963 and maintained barren with herbicides until 1969. This is a companion study to the one on Watershed 6 and was designed to determine what portions of watersheds produce water and to provide some landmark values on hydrologic effects of complete deforestation.

(15) WATERSHED 6: This study was designed to determine how converting a hardwood covered watershed to a coniferous cover affects the quality and quantity of water draining it. In 1973 the entire watershed was planted with Norway spruce. Streamflow is expected to decrease as the spruce grows older, eventually becoming at least 25 percent less than the streamflow measured when the watershed was occupied with a hardwood cover. This long-term study is expected to continue well into the 21st century.

Evaluation of Oak Regeneration Using Plastic Tubes.

NORTHEASTERN FOREST EXPERIMENT STATION RADNOR, PENNSYLVANIA 19087

For Additional Information Contact:
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